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DISEASES OF THE REPRODUCTIVE ORGANS IN FROGS, BIRDS, AND MAMMALS. By J. BLAND SUTTON, F.R.C.S., *Lecturer on Comparative Anatomy, and Senior Demonstrator of Anatomy, Middlesex Hospital Medical School.* (PLATE VIII.)

IN 1792 John Hunter wrote the following sentence:—"A spirit of inquiry concerning facts in natural history is diffused through all ranks of men, and those who cannot pursue it themselves, choosing to benefit by the industry of others, are eager to be informed of what is already known."

So little accurate knowledge is on record concerning the affections of the reproductive organs in animals, that the facts to be related in the following pages may not be unwelcome to those interested in the subject. Morbid conditions of the uterus will first occupy attention.

Flexions of the Uterus.

The first case encountered is recorded in the *Trans. Path. Soc.*, vol. xxxiv. p. 326, 1883. It was an example of retroflexion of the uterus which occurred in a West African baboon. The fundus was acutely retroflexed, and the posterior wall of the uterus had suffered atrophy. The animal had lived for some time in the Zoological Gardens. Since that case was published several examples of a similar character have come to hand.

The next case to be described was found in a Macaque monkey. The rectum in monkeys, as in the human fœtus at birth, normally descends at the back of the pelvis lying exactly in the middle line. In this instance, however, it entered into the pelvis on the right side; immediately above the anus it became distended, so as to force the uterus upwards and forwards. In this way the uterus became to a certain extent deprived of support from the pelvic organs, which resulted in its bending backwards in a condition of flexion, at the same time being considerably pushed to the left side.

The third example was found in a Bonnet monkey, *Macacus sinicus*, extremely distorted with rickets. The bones in all parts of the body were so soft, and yielded to pressure to such an extreme degree, that the opposite sides of the pelvis were almost in contact. This narrowing of the transverse diameter of the pelvis had caused the bladder and the uterus to be squeezed out of the pelvis to such an extent, that the upper part of the vagina and the neck of the uterus were found lying above the brim of the true pelvis. In this elevated position, deprived of support from the bladder and rectum, and at the mercy of the intestines, it is not surprising that the fundus of the uterus should have been doubled over in the condition of acute anteflexion (Plate VIII. fig. 1).

In August last, a monkey, *Cercocebus collaris*, died, after a residence in the Gardens of four years. Every bone in the skeleton was softened with rickets, the pelvis being extremely affected. The uterus had been considerably elevated into the abdomen, as a result of the contraction of the transverse diameter of the pelvis, and had become flexed so acutely to the right side, that the fundus was found resting on the right psoas muscle. The uterus at the point of flexion was considerably narrowed, and the walls had atrophied (Plate VIII. fig. 3).

The ovaries were large and hard to the touch, and looked more like testicles than ovaries. On microscopic examination, they were found to be ovaries, with an amount of dense fibrous tissue in their structure; this accounts for their extreme hardness. The clitoris was of enormous size, surpassing in this respect the penis of a male. It is well known that in certain of the Cebidæ, particularly in *Ateles*, the clitoris does attain naturally enormous proportions, but in this particular case the clitoris far exceeded the average size it attains even in the spider monkey.

These two last cases of malposition of the uterus, as already mentioned, were undoubtedly the result of rickety contraction of the pelvis. The following case will serve to illustrate the fact beyond question. A hybrid Macaque monkey, a male, was born in the Zoological Gardens. It was four months old, and died from pulmonary collapse, with rickety changes in every bone.

The pelvis was remarkably distorted on account of the extreme softness of the bones. The pelvic diameters were all shortened, and the cavity so encroached upon by the yielding walls, that the bladder, prostate, and vesiculæ seminales were squeezed into the abdomen; the apex of the prostate actually rested on the symphysis pubis. So narrow was the antero-posterior diameter at the brim, that the rectum and neck of the bladder were squeezed between the symphysis and the vertebral column. Figures 1, 2, and 3 on Plate VIII. represent three typical displacements of the uterus, viz., ante, retro, and lateral flexion.

In each of these cases the pelvis with its contained viscera has been represented, in order to avoid mistakes or exaggeration.

Leaving monkeys, some cases of flexions of the uterus occurring in other animals will now be described.

Two years ago the rare and pretty little animal *Hyomoschus* gave birth to a young one in the Zoological Gardens; some three months later it died. On examination, the uterus was found large and the fundus acutely anteflexed. Of course the question arose, May it not be the natural position of the uterus? Fortunately I had examined two specimens previously, and can state that their uteri were not in the position of this example.

Since obtaining this specimen, a large number of deer, gazelles, antelopes, &c., have been examined, and it is not uncommon to find a small degree of curvature existing at the fundus uteri, but it is in so slight a degree that the tonicity of the walls of the organ never allow the fundus to come in contact with the anterior wall of the uterus in health. An example has since occurred in a Mollucca deer, *Cervus mollucccnsis.* The animal died from the effects of some acute febrile disease.

The fundus of the uterus was so acutely anteflexed that it was in contact with the anterior wall of the organ, and had, by its pressure, caused atrophy. This malposition had evidently existed some long time, for dense fibrous bands stretched across the line of flexion and prevented the fundus returning to its normal position (fig. 4). These cases must prove beyond question that *flexions of the uterus occur in animals as well as in the human female,* but so far as can be ascertained the animals were in no way inconvenienced by the abnormal condition of the parts.

A very curious case of atrophy of the uterus occurred in a lioness. The uterus, Fallopian tubes, ovaries, and vagina were represented, but were of smaller size than the corresponding parts in a common cat. The animal was well nourished, and nothing reasonable can be advanced to explain the very small dimensions of the uterus and its appendages. It had never borne young ones.

Pyo-salpinx.

In June 1884, a kangaroo died in the Zoological Gardens from peritonitis. The abdomen was considerably distended, and the viscera matted together by adhesions of some old date. On examining the pelvic viscera, two swellings were found occupying the Fallopian tubes.

As the uterus and its appendages are somewhat complicated in the Marsupials, it will be advisable to give a short description of the parts as seen in the normal condition. In Plate VIII. fig. 5, is represented the vagina, which has passing off at its upper extremity two tubes, the lateral canals which open eventually into the uterine cavity (median canal), which below forms the median chamber ending usually in a cul-de-sac. From the upper end of this median chamber the orifices of the Fallopian tubes may be seen when the median canal is slit up. The ostia of the tubes present the usual fringed appearance, lying in close proximity to which may be seen the diminutive ovaries. The exact functions of the various parts of this complicated organ are not thoroughly understood by anatomists. The points about which information is required are these:—Do the young pass down the median canal, and establish an opening between the uterus and vagina, or do they come by way of the lateral canals? Or, are the lateral canals for the passage of semen only?

Messrs Lister and Fletcher published an admirable résumé of the question in the *Proc. Zool. Soc.*, 1881, entitled "The Vaginal Apparatus of the Macropodidæ." The following is a summary of their research:—

1. In the very early condition of the Macropididæ the median canal is closed.
2. In some genera, viz., Macropus, Halmaturus, Petrogale (Dorcopsis and Dendrolagus), an opening is formed in the median canal, to give passage to the young. This may take place in early life (Halmaturus), or not until the young are about to be produced (Macropus).
3. In the species *Macropus major*, however, this opening may or may not exist, and the young are transmitted either through the median or lateral canals.
4. In Hypsiprymnus, the median canal remains closed, and the young pass down the lateral canals, which differ in their structure from those species just quoted.

The normal anatomy and probable function of the various parts have been detailed, because they have an important bearing on the case before us. In all examples of marsupial uteri coming under my notice, a large quantity of mucus was present in all these passages. It seems to me that the very trifling amount of inflammation necessary to arrest the flow of secretion through the lateral canals, in cases where the median canal is imperforate, readily accounts for the distension of the Fallopian tubes. On opening these tubes in the present case, they were found filled with pus and caseous material. My opinion is, that this purulent matter gradually leaked into the peritoneal cavity through the abdominal openings of the Fallopian tubes, and had given rise to recurring attacks of peritonitis, which eventually proved fatal.

Diseases of the Ovaries and Oviducts.

Since Caspar F. Wolff, and the two princes among observers in biological science, Rathke and Johannes Müller, worked out the main points in the history of the remarkable series of changes which occur during the development of the mammalian reproductive organs, a sort of fascination seems to have surrounded this subject, to judge from the large number of talented observers in embryology who have been attracted to this question. Before entering into details concerning the pathology of these organs, it will be well to trace briefly the chief points in the formation of the various structures, for unless a clear conception be formed of the development of the parts, some misunderstanding may arise. Later researches, particularly those of Semper and Balfour on the Development of Elasmobranch Fishes, enable us to recognise three typical parts to these organs, each of which agree fundamentally, in that they consist of two parts, a glandular mass with its correlated duct. These ducts, in the early embryo, open posteriorly into the cloaca. The three segments may be thus classified :—

Fig. 1.

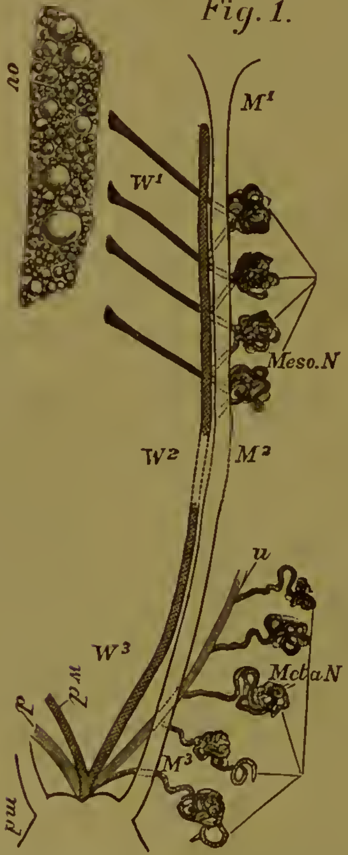

Diagram to show the relation of the Genital Ducts in the Embryo (*vide* text), after Balfour.

1. A glandular mass known as the Pronephros or Head Kidney. Its associated duct is known as the Müllerian Duct.
2. The Mesonephros or Wolffian body, in relation with the cloaca by means of the segmental or Wolffian Duct.

The gland is brought into connection with its duct by means of the segmental tubes (*vide* fig. 1).

3. The Metanephros or Kidney having for its excretory duct the ureter. This will not further concern us.

A glance at fig. 1 (text) will help to make the description more intelligible. M^1, M^2, M^3, indicate Müller's Duct. W^1, W^2, W^3, the Wolffian or Segmental Duct, with its transverse tubules and the Mesonephros; *u*, refers to the ureter with the Metanephros.

Of these ducts we are concerned with two only, the Wolffian and the Müllerian.

These ducts undergo a series of remarkable changes, which with the help of a figure may be thus described:—

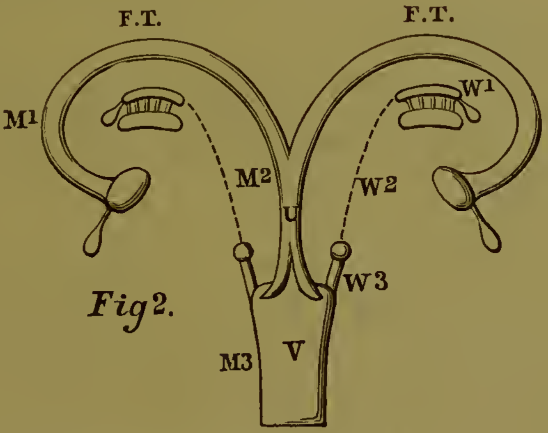

Fig 2.

Diagram to show the metamorphosis of the Müllerian and Wolffian Ducts in the Female (*vide* text).

1. *The Müllerian Duct.*—In the female this duct develops into an oviducal passage in fish, amphibians, reptiles, and birds, but into an uterus in mammals. The formation of the uterus and its essential parts takes place after this manner.

The Müllerian duct may be conceived as being made up of three parts:—

The upper third becomes the Fallopian tube, the funnel-shaped opening communicating with the peritoneal cavity, and supports a tiny cyst, commonly known as the "Hydatid of Morgagni," but for pathological, if not for anatomical, purposes would be much better termed the "Müllerian cyst."

The middle portion of each duct fuse together, and form the fundus, body, and neck of the uterus, whilst the lower third of the Müllerian ducts join together and form a vagina. Such is the commonest arrangement.

In the accompanying woodcut (fig. 2, text), the letters M^1, M^2, and M^3 refer to the three portions of the duct after the metamorphosis.

2. *The Segmental* (*Wolffian*) *Duct.*—This duct and its associated tubules has no function in the female, but its atrophied remains are often to be detected. Like the preceding duct, it may for the purpose of convenient description be divided into thirds.

The upper division, with the segmental tubes, may be detected lying above the ovaries in the folds of the broad ligament, and is commonly referred to as the "Organ of Rosenmüller," or better the "Parovarium."

The middle portion usually atrophies, whilst the third portion often forms a narrow tube lying in the broad ligament, and running towards the upper part of the vagina is recognised as the duct of Gärtner (*vide* fig. 2, W^1, W^2, W^3).

The Parovarium (Organ of Rosenmüller).

Apart from its anatomical interest, great importance attaches itself to this structure, on account of the relation it bears to cystic formations occurring in the neighbourhood of the broad ligament.

The parovarium may be easily seen by holding the mesosalpinx between the eye and the light, then a series of tubules will come into view, radiating from the ovary to join a longitudinal tube situated at right angles to them. Although these tubules converge at their ovarian end, nevertheless they remain distinct; they are lined with epithelium, and each tubule ends blindly. In form and disposition they recall exactly the arrangement of the vasa efferentia and commencement of the epididymis in the male—indeed it is these ducts which in man constitute that portion of the excretory apparatus of the testicle.

It has been clearly proved by many observers, that in the human female the ducts in question are very liable to become distended with fluid, so as to form pedunculated cysts, usually of small size, but now and then they assume disagreeable proportions. The cysts may arise either by distension of the vertical tubes or by dilatation of the longitudinal one.

Examples of cysts arising after this manner will be fully considered later on.

Gärtner's Duct.

This duct, which was first detected in cows and swine by Gärtner in the year 1822 is occasionally present in the human female, and may be detected as a tube in the broad ligament of the uterus, but lower in its course, becomes incorporated with the walls of the vagina, occasionally opening on the mucous surface of that tube.[1] This functionless duct may become the seat of cystic formations.

The clearest and best described example of a cyst originating in this duct, that I am aware of, will be found in Virchow's *Archiv für Pathologische Anatomie* (Band xcvi. Heft 1, s. 100). Carl Rieder there contributes a paper of considerable interest, entitled "Ueber die Gärtner'schen (Wolff'schen) Kanäle beim Menschlichen Weibe," wherein the literature and frequency of persistence of this structure in various animals, including man, is ably discussed. Not the least interesting point in the paper is the description of a preparation from the collection of the Pathological Institute at Basel, of a case of multiple cysts in the walls of the vagina of a woman, aged twenty-eight years, who died in the fifth month of pregnancy. Rieder's object is to prove, and this he does very conclusively, that the cysts in question were the result of abnormal dilatation of Gärtner's ducts.

The Müllerian Ducts in Male Frogs and Toads.

For some time past I have devoted considerable attention to cases of ovarian disease occurring in wild and other animals; very many cases of considerable interest have come under notice in the course of my work at the Zoological Gardens, and many others have been derived from various sources.

At the outset attention is invited to certain abnormal conditions of the Müllerian duct in male frogs and toads which will go to show *that it is a condition exceedingly common for functionless ducts to become cystic in animals other than man.*

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[1] The opening of the ducts known as Skene's tubes must not be confounded with Gärtner's ducts. The former are associated with two glands lying in the wall of the vagina near where Gärtner's ducts usually terminate.

In the male of the common frog, *Rana temporaria*, the generative organs have the disposition exhibited in Plate VIII fig. 6*a*. They may be thus described:—On either side is seen the testis, surmounted by the corpus adiposum, with *u*, the duct which functions as the vas deferens as well as a ureter: *v.s.* are the vesiculæ seminales with the Müllerian ducts, which, in the female become enlarged to function as oviducts, are here seen as delicate thin streaks ascending in the peritoneum, from the summit of the vesiculæ to the root of the lungs.

Although the vesiculæ seminales in the frog give one the impression that they are dilatations of the Müllerian duct, nevertheless, as a matter of fact, they belong to the Wolffian duct; but their mode of origin has no bearing on the subject of this paper, and will not be considered any farther.

In the toad *Bufo vulgaris*, the most important features are these—

Between the testis and the fat body is a singular structure, called in honour of its discoverer "Bidder's Organ." This organ, according to the most recent researches, is nothing more or less than a rudimentary ovary, and as such seems to exercise a very remarkable influence on the degree of development of Müller's duct in the male toad.

In frogs, as we have seen, the Müllerian duct in the male is scarcely perceptible, but now and then it happens that a frog sometimes develops a "Bidder's organ," or ovary in conjunction with the testis, forming what amounts to an ovo-testis, and singularly enough the Müllerian duct or oviduct then assumes some considerable size. For the purpose of testing this question in toads, more than two hundred and fifty have been examined. It would appear that, as a rule, *the amount of development of these ducts is in direct proportion to the size of "Bidder's organ."* But the point which concerns us most as pathologists is, that it is exceedingly common to find a *cyst* developed in these rudimentary oviducts in the toads. A characteristic example of the cystic condition is shown in Plate VIII. fig. 6, so that these batrachians afford ready and indisputable examples of *functionless ducts becoming cystic in parts of their course.*

Cysts in Birds.

In birds, as in frogs and toads, upon the Müllerian ducts devolve the duty of safely conveying the ova from the peritoneal cavity to the exterior. In the early chick both Müllerian ducts and ovaries are equally developed, but in the mature bird the left duct and ovary alone persist, the right having atrophied. In the majority of birds no trace of the right duct remains, except a small tube, about an inch long, attached to the right side of the cloaca, often bearing on its summit a small nodule of fat, the degenerated representative of the remaining portion of the duct.

The persistent left oviduct may be thus described:—

In the quiescent state the duct is nearly straight, but during the breeding season it undergoes considerable enlargement and becomes convoluted. It is maintained in position by a fold of the peritoneum, and extends from the cloaca posteriorly, and terminates by opening anteriorly into the peritoneal cavity just below the ovary, by a funnel-shaped termination known as the infundibulum. It will be convenient to describe this tube as made up of four parts.

1st. The dilated infundibulum, with its thin delicate walls; this is followed by the

2nd portion, long and tubular, constituting the oviduct proper; this opens by a narrow constricted portion into the

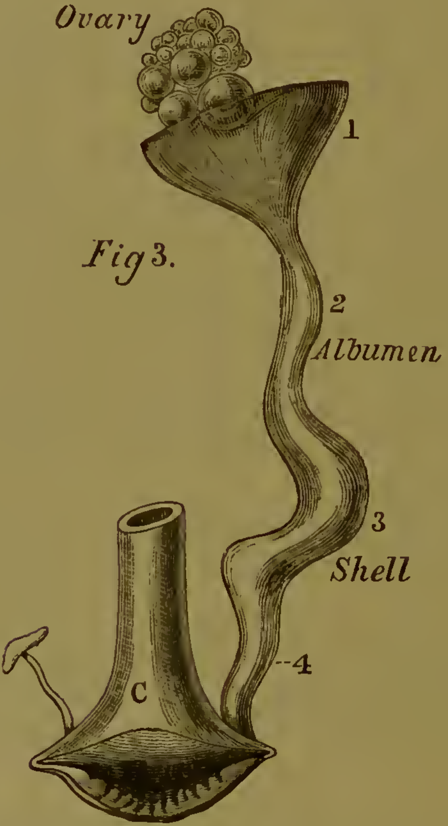
3rd, or uterine part, which is much larger than the other divisions of the tube, and possesses fairly thick muscular walls.

4th. This is somewhat narrow, and leads from the uterine portion into the cloaca. The oviduct is lined throughout with mucous membrane covered by ciliated epithelium. In some parts of the tube the mucous membrane is thrown into spiral ridges.

The various portions of the oviduct are indicated in fig. 3 (text).

When the ovum escapes from its follicle in the ovary, it as a rule falls into the infundibulum of the oviduct, passing thence into the second and third portions of the tube; during its passage through the second portion or oviduct proper, it acquires a layer of albumen, and the spiral motion given to the egg by the ridges in the mucous membrane as it descends, form the chalazæ (because these bands contain little white spots, hence χάλαζα, hailstones), or twisted bands formed of denser albumen attached to the two opposite portions of the yolk; later on the chalazæ are also enveloped in albumen. In the third portion of the tube the shell is formed. The mucous membrane of this, the uterine portion, contains some follicular glands which secrete a thick white fluid; this coats the egg, and serves as a nidus for the inorganic particles which ultimately form the shell.

Fig 3.



Reproductive Organs of the Female Bird (*vide* text).

The transit probably occupies on an average twenty to twenty-four hours, of which more than three-fourths are spent in the uterine portion of the oviduct.

In the first place, some abnormal conditions of the rudimentary right oviduct will demand attention. From what has been stated in respect of frogs and toads, it will of course not surprise us to find that the remains of the Müllerian duct of the right side should occasionally be found in a cystic condition. Such is indeed the case. Whilst engaged in making a *post-mortem* examination on an old barn-door hen that had died paraplegic, in consequence of myelitis, it was observed that the rudimentary right oviduct was present, not as a narrow tube about an inch in length, but as a cyst the size of a gooseberry, filled with serum-coloured fluid, whilst attached to the upper extremity by an exceedingly narrow pedicle was a second cyst of the size of a cherry, also containing fluid of similar character.

That such cysts may be a source of danger to a bird, who is so unfortunate as to possess them, is well illustrated in a case now to be related.

A black-neck swan died from the effects of acute peritonitis, the cause of which for a time was somewhat obscure. When examining the cloaca, a distended tube about an inch long, the remnant of the right oviduct, was observed; attached to its summit was the narrow pedicle of a cyst, the main portion of which could not be found. It would seem that in this case the cyst had become detached, or its contents extravasated into the peritoneal cavity, producing peritonitis with a fatal result. The viscera of the bird were in other respects healthy.

In Plate VIII. fig. 7, is represented the cloaca of a hen with the left oviduct cut short. On the right side may be seen a rudiment of the right oviduct, which, in its upper part, is of the usual size of this remnant when present. In its lower part, however, it affords an example of a very early stage of the cystic condition. The bird was old, and had ceased to lay eggs.

During the present year, whilst on a visit to my friend Mr Edward Swan of Middlesborough, who, being much interested in questions of comparative pathology, kindly placed some of his fowls at my disposal for purposes of dissection. One of these birds afforded me the best example of an oviducal cyst I have yet encountered.

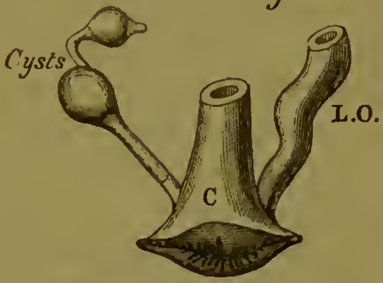
The bird was a Spanish hen, and on opening the abdomen we found lying on the right side of the cloaca a cyst measuring 3 inches in length, and supporting on its summit, by a narrow pedicle, a second but much smaller cyst. Its general appearance and shape may be inferred from fig. 4 (text). The walls of the cysts were exceedingly delicate, transparent, and enclosed a quantity of thin watery liquid, in which small particles of coagulated albumen floated. This was also an undoubted example of a dilated rudimentary right oviduct.

The Teratological Series in the Museum of College of Surgeon's possesses an example of a cystic oviduct in a bird. It is thus described in the Catalogue:—

"The sacrum of a young fowl with the right oviduct persistent. It forms a large thin-walled cyst, which was distended with air. The left oviduct was normal; it has been removed, but its orifice is indicated by a bristle. The specimen was presented by Mr W. B. Tegetmeier."

A careful examination of this specimen shows, that in this case, as in the preceding ones, the structure in question is a remainder of the right oviduct, which has become distended so as to form a cyst.

Fig. 4.



Cystic right Oviduct in a Hen, reduced to ¼th natural size (*vide* text).

The same series contains also an admirable example of the oviduct with the ovary of a hen, which during life laid eggs about the size of a pigeon's, consisting exclusively of albumen, covered by a very perfect shell. The oviduct was too small to transmit the yelks, for when the abdomen was opened, the peritoneal cavity was found to be full of the yellow fluid contents of the yelks, which had escaped. It would appear that as each yelk was matured, it fell into the abdomen, and was ultimately absorbed, whilst the oviduct poured out albumen, and formed a shell, as it would if the yelk had fallen into the oviduct. The hen when killed was apparently healthy. Specimens of the eggs are preserved in the Museum; they consist of normal albumen enclosed in a small but well-formed shell. This specimen throws important light on a circumstance which puzzled me extremely as a boy. Most persons who have visited poultry yards must have noticed that it is extremely common for pullets to lay small eggs without yelks, and as boys the explanation was, "that the pullet had not yet acquired the art of laying properly!"

However, it now and then happens that a hen in "full lay" will deposit an egg of small size without a yolk. Shrewd country people explain this by saying, "that the preceding egg contained two yelks,"—a subtile explanation truly. It is clear enough, at least to me, that in these cases the ovum either fails to fall into the oviduct, or if it does reach that duct it may, by some accident, be tossed out, and falling into the peritoneal cavity, become absorbed. With regard to mammals, it is well known that the impregnated ovum does now and then miss the Fallopian tube, and in other instances reaching that duct, fails to pass into the uterus, both conditions coming under the term extra-uterine fœtation. In all cases of extra-uterine gestation, the mucous membrane of the uterus undergoes hypertrophy, in the same way that it would, if the impregnated ovum had tumbled into its cavity, as in the course of events in normal pregnancy. Remembering that the shell, with its membrane and albumen, correspond in a great measure to the decidua of mammals, at any rate the greater part of the decidua, like the albumen and shell of the bird's egg, are the direct result of the activity of the uterus and uterine portion of the oviduct respectively, we have in these two instances parallel circumstances, viz., the presence of a shed, and probably impregnated ovum, exerting an influence on the uterus, though it be at some distance from the part; hence this is clear, it is not merely actual contact of the ovum with the uterine mucous membrane that brings about the formation of the uterine decidua, but some "subtile influence" we know not of.

It may not be out of place, or inconsistent with the general tenor of this article, to give some further examples of this 'subtile influence" on the general economy of birds.

Effects of Ovarian Disease on Birds.

John Hunter has placed on record some interesting facts bearing on this question, in his account "Of an Extraordinary Pheasant." It appears that now and then a hen pheasant is seen with the feathers of a cock; the animal does not breed, and its spurs do not grow. Dr Pitcairn received a bird of this kind from Sir Thomas Harris, and showed it to Sir Joseph Banks and Dr Solander; Hunter being present, examined the bird, and found that it possessed *two ovaries and oviducts.*

Among the other cases instanced by Hunter, the following is the most remarkable:—

Lady Tynte had a favourite pyed pea-hen which had produced chickens eight several times. Having moulted when about eleven years old, the lady and family were astonished by her displaying the feathers peculiar to the other sex, and appeared like a pyed *peacock.* In this process the tail, which became like that of a cock, first made its appearance after moulting; and in the following year, having moulted again, produced similar feathers. In the third year she did the same; and, in addition had spurs resembling those of a cock. She never bred after this change in her plumage, and died in the following winter during the hard frost, in the year 1775–6.

These facts are extremely interesting, for as Hunter points out, we find similar changes taking place in the human species; for the increase of hair observable on the face of many women in advanced life, is an approach towards the beard which is one of the most distinguishing secondary properties of man.

When females pass the child-bearing period of life, that is when the ovaries become functionless, they often assume more or less masculine characters.

The assumption by the female of feathers somewhat like those of the male bird, is a fact, so far as I can ascertain, first placed on record by John Hunter, and it has caused other naturalists to inquire into the question. Yarrell communicated a paper to the *Phil. Trans.*, 1827, on the subject; the following is the pith of his researches:—

He had an opportunity of examining seven hen pheasants, in plumage more or less resembling the male, and in all of which the sexual organs were diseased, but with some variation as to extent. The ovary was contracted in size, of a purple colour and hard to the touch. The oviduct was diseased throughout its whole length.

Some cases are also quoted at length to show that the change in the sexual organs precedes the alteration in the plumage. That this change in the feathers is secondary to affections of the sexual organs the following facts bear testimony.

The poultry breeder learns, from the attempts of the young bird to crow, that the testes have enlarged sufficiently for him to perform castration. After the operation is performed, the bird never crows again. The combs, gills, and spurs remain short and blunted, and the feathers put on an appearance intermediate to those of the cock and hen.

The operation on the female bird consists in making a small incision through the skin on the flank of the left side, and so on until the oviduct is reached, and a piece cut away. After the operation the ova do not enlarge, and the hen makes an attempt to imitate the crow of a cock, there is an increase in the size of the comb, and a spur or spurs shoot out, but remain short and blunt. The feathers also undergo a change in colour.

Another peculiar feature in these unsexed hens is the singular shape of the lower part of the back,—due to the want of enlargement of the bones observed in all true females, by which they attain a breath of the pelvis sufficient to allow the eggs to pass.

It is well known that the beautiful plumage which many birds assume in the spring is coincident with the dilatation of their sexual organs under the influence of the genial weather.

Yarrell entered carefully into the matter of disease of the sexual organs being a cause of this singular change of plumage, because Dr Butter, in the *Wernerian Transactions*, vol. iii., states that all hen birds would acquire this change of dress if they lived to be old enough; this of course is erroneous, *the change coming on in old birds is the result of the cessation of ovarian activity.*[1]

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[1] Prof. Turner has described, in *Proc. Roy. Phys. Soc. Edin.*, vol. iii. p. 297, 1862–66, a bantam hen, aged 13, which had assumed male plumage and developed a well-formed spur on the left leg. The ovarium was shrivelled and the ova atrophied. Numerous pea-like bodies, containing a yelk-like fat, were either lying loose in the abdominal cavity or attached by short pedicles to the peritoneal lining. They seemed to be aborted or degenerated ova.

Darwin refers to the fact in the *Descent of Man*, as though it were well recognised. After writing concerning the females of certain species of birds which, in the first year or two after they are hatched, differ in colour from the males, nevertheless later in life naturally acquire the coloration &c., of the male (*Falco peregrinus, Bombycilla carolinensis, Palæornis javanicus*), he says—

These cases must not be confounded with those where diseased or old females abnormally develop masculine characters.[1]

Dr Larcher has published, in the *Journal de l'Anatomie et de la Physiologie*, Nov. 1873, an article on "Les Affections des Parties Génitales Femelles chez les Oiseaux," where, among other conditions, this relation between feathers and sexual organs is discussed and further evidence offered, so that the phenomenon in question is beyond doubt.

The most remarkable instance of change of plumage in a hen bird, that has come under my own notice, concerns a female golden pheasant now living in the Pheasants' Aviary in the Zoological Gardens, London. A pair of birds, male and female, were presented to the Society by Sir H. W. Tyler, M.P., but the hen bird presents all the resplendent dress of the male bird, even to a slight yellow coloration on the legs. On comparing her with the male bird, the following differences only can be perceived:—The eye is perfectly dark, whereas in the male bird a ring of white encircles the iris, and the colour of the plumage is not quite so brilliant as in the male, and she has no spurs. Mr Misselbrook, the head-keeper at the Gardens, informs me that the bird has undergone two moults. In spite of the deceit of feathers, the male bird lives with her quite happily, and they have not been seen to fight. On several occasions I have seen a male bird in the next cage, who was companionless, making overtures towards his neighbour's hen in spite of the assumed plumage.

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[1] In cases of hermaphroditism occurring among Lepidoptera one side presents the characteristics of the male, the other half those of the female. Also, the female may assume the coloration of the male where normally the colour of the two sexes widely differs (J. Jenner Weir, *Entomologist*, Aug. 1883).

Ovarian Cysts in Mares.

We must now pass on to consider some cases of cystic disease of the ovaries occurring in mares.

Some years ago a friend gave me for anatomical purposes an old carriage mare; during the dissection, it was observed that both ovaries were enlarged to the size of an orange (the normal size equals a walnut), their increased dimensions resulting from the presence of several cysts.

The specimen remained in spirit for three or four years.

Last winter I investigated the matter.

The ovaries of fifty mares, chosen promiscuously, were collected; but most of the animals were killed on account of their age, none from disease. Of this number two-thirds presented me with cystic ovaries. Each affected ovary was found to contain from two to six cysts, varying in size from a grape to an orange. Plate. VIII. fig. 8, may be taken as a fair illustration of this condition.

My first impression was that these cysts were really enlarged Graafian follicles, and a few doubtless do arise from this source, but the majority have an origin of a very different character.

When describing the parovarium, attention was drawn to the fact that the tubules composing that organ converged towards the ovary. If a little care be exercised these tubules may, in very young subjects, be traced for a short distance into the substance of the ovaries.

The *Trans. Path. Soc.*, vol. xxxii., 1881, is enriched by a paper from Mr Alban Doran concerning some proliferating cysts which he found in the ovary of a seven months' fœtus. In this case Mr Doran clearly and ably associates these cysts with remains of the Wolffian bodies and tubules well known to occupy this region.

After reading Mr Doran's paper, I kept careful watch among the many fœtuses dissected at the Middlesex Hospital for similar cases, and have been rewarded by finding an excellent example of a cystic ovary in a fœtus born at full time. In this case the cyst was not embedded in the substance of the ovary, but was at once visible on examining the parts, as a distinct projection, on the outer surface of that organ. The cyst was of the size of a split pea, and contained clear fluid; careful examination of the specimen seems to show that it was the result of abnormal distension of a parovarium tubule where it joined the ovary.

Returning to mares, the following points are worthy of notice:—

1. The cysts in question are most common in old mares, and at a time when they cease to propagate.
2. The majority of the cysts occupy the meso-salpinx, and are unconnected with the ovary.
3. Those cysts which encroach upon the ovary, do so by their pressure causing absorption of the ovarian tissue.

Several instances have come under my notice where nearly the whole of the ovary has been absorbed by the pressure of such cysts.

If this view as to the origin of these cysts is correct, the following question naturally arises, Why should these tubules remain quiescent throughout the youth of the animal, when growth is in full vigour, to attain unnatural dimensions in old age?

The same question might be put with equal fairness to the case of the prostate of man, and the following answer applies with equal force to both cases.

In the ovary of the mare, as with the prostate of man, there is a great tendency for the veins to dilate and become surcharged with blood. In the case of the mare the plexus is of remarkable size, and the individual branches of the veins are very large.

Venous stagnation leads to dropsy, and to hypertrophy very often, hence it is not very unreasonable to suppose that these examples of increased growth of parts, previously quiescent, may depend on venous engorgement.

Plate VIII. fig. 8, is intended to show the relation of the large veins to the ovary in an old mare.

In support of this view, attention may be called to an observation by Banks (*On the Wolffian Bodies and their Remains*, 1864), that the growth of the "Organ of Rosenmüller" keeps pace with the uterus and its appendages. It has been noticed that after parturition the organ is red and tumified. In the sheep it is always best seen during pregnancy, and this condition seems to have a very decided effect upon its development.

From this it is obvious that increased blood supply does affect the parovarium, and the above facts come in as excellent testimony to the notion I have ventured to suggest, *that passive hyperæmia plays a part in causing these tubules to take on abnormal growth.*

Leaving mares, we must now pass on to consider a few examples of cysts, connected with the parovarium in other animals.

In March 1833, I communicated to the Zoological Society a paper (since published in the *Proccedings* for 1884) on the "Diseases of Carnivorous Mammals." Among the cases there recorded is an example of ovarian disease in a tiger. The animal was of splendid proportions, and had been born in confinement. It was twelve years old, death having been brought about by an attack of lobar pneumonia. Both ovaries presented abnormal conditions. The right ovary contained three solid tumours about the size of a nut, and of a reddish colour, one of them being pedunculated. Two cysts of the size of a cherry occupied the substance of the organ. The left ovary presented three of these reddish solid growths, two of firmer consistence than the rest and pedunculated. A cyst the size of a gooseberry occupied the substance of the ovary. Hanging from the meso-salpinx is a cyst the size of a cherry, attached by a narrow pedicle, whilst hanging among the fringes of the abdominal end of the Fallopian tube are numerous pedunculated cysts the size of millet seeds. The solid growths, when examined microscopically, exhibited a structure similar to corpora lutea. In this case, as in that of the mare, there can be little doubt that these cysts result from dilatation of the tubules composing the parovarium.

It seems to me that, ovarian and parovarian affections are by no means common in "wild animals," but occur with tolerable frequency in domestic animals. Many carnivorous animals have been examined *post mortem,* during the past three years, and in every case the uterus and its appendages have been particularly inspected; hence it appears remarkable that the first case should be found in tiger born and bred in the captive state! A well-marked example of cystic ovarian disease came under my observation in a common cat. The right ovary had dwindled to the size of a split pea. The left one has two cysts developed in connection with the ovary itself, of the size of small grapes, whilst hanging pendulous from the Fallopian tube are several smaller cysts with well-marked pedicles; these smaller bodies obviously arise by dilatation of the parovarian tubules.

In an uterus and its appendages taken from a tree porcupine which lived for some time in the Zoological Gardens, the left ovary was occupied by a cyst the size of a small gooseberry, which has encroached for a considerable extent on the proper structure of the ovary, which has atrophied in consequence. There is yet a singular class of cases to be discussed:—

It is a curious and noteworthy fact that in many cases of malformed and defective uteri I have had opportunity of examining, the ovarian and parovarian bodies were the seat of cystic dilatation. The following case, taken from a goat, will serve as a characteristic example. The uterus and vagina were nothing more than a narrow tube—a papilla indicated the opening of the urethra. The uterine cornua were dilated, but they had no connection with the middle tubular portion, which were distended with thick mucus. Hanging from the ends of these dilated portions were the diminutive ovaries; the left one was absorbed in great measure by the pressure of a cyst the size of a cherry.

A critical examination of this case seems to demonstrate that the tube formed by the confluence of the two Müllerian ducts, in the usual course of development, had failed to advance any further in the formation of an uterus, and had simply persisted as a duct, merely undergoing an increase in proportions. Hence, given an imperfect uterus, the ovaries are necessarily useless structures, and become prone to assume morbid change. Such cases are by no means unknown in the human female, and the cystic ovary and parovarium represented in Plate VIII. fig. 9, was taken from a girl, aged 18 years, who possessed an uterus which had never passed beyond the "tubular" condition, or stage of confluence of the Müllerian ducts. In this case the ovary was bedecked with numerous pedunculated cysts originating in the parovarian tubules.

The facts recorded in the preceding pages ought not to be regarded as mere curiosities, in that they serve as instances of disease occurring in animals; nor should they be estimated as merely interesting in that they illustrate truths which might *à priori* have been anticipated. The investigation was originally undertaken for the purpose of determining how far the notion that *cysts may originate in functionless ducts and tubules,* would hold its ground, if the view were extended to animals in general.

How far I have succeeded must be left for others to determine. To me it has been a labour of very great pleasure, and my hope is, that others more capable of judging may not esteem this work "labour in vain," or "valueless."

EXPLANATION OF PLATE VIII.

Fig. 1. The pelvis, with the bladder, uterus, and rectum of a Macaque monkey. The uterus is anteflexed.

Fig. 2. The pelvis and its contained viscera, from a monkey. The uterus is retroflexed. The parovarium is cystic on both sides. The right ovary lay behind the fundus of the uterus, but in the drawing it is drawn out so as to show the cysts.

Fig. 3. The pelvis of a monkey (*Cercocebus collaris*). The uterus is flexed laterally, and its fundus rests on the right psoas muscle.

Fig. 4. Uterus of a Mollucca deer (*Cervus molluccensis*), showing an anteflexed fundus associated with atrophy of the anterior wall of the uterus, due to the pressure of the flexed fundus.

Fig. 5. Uterus of a kangaroo. The Fallopian tubes were distended with caseous matter—pyosalpinx.

Fig. 6. The genito-urinary organs of a male toad (*Bufo vulgaris*), showing cystic dilatation of the Müllerian ducts.

Fig. 6-*a*. The generative organs of the male of the common frog (*Rana temporaria*), page 130.

Fig. 7. The cloaca of a bird, with the lower end of the left oviduct. The rudimentary right oviduct has commenced to assume a cystic condition.

Fig. 8 The right ovary and Fallopian tube of a mare. The ovary has undergone atrophy, due to the pressure of cysts which occupy the meso-salpinx.

Fig. 9. The ovary, Fallopian tube, and parovarium, which is cystic, from a girl æt. 17.

Journ. of Anat. & Phys. Jan. 1885.

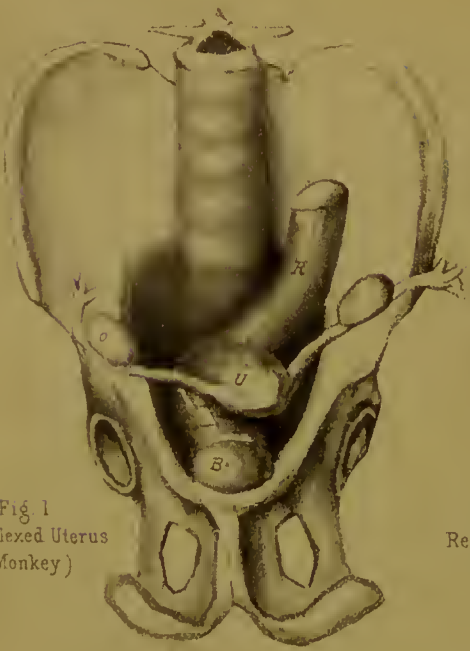


Fig. 1
Anteflexed Uterus
(Monkey)

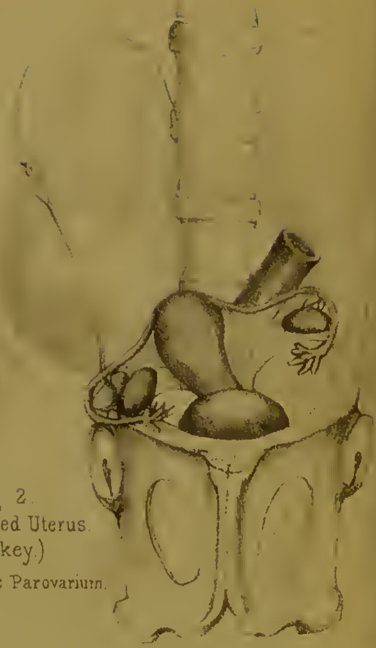


Fig. 2.
Retroflexed Uterus.
(Monkey.)
Cystic Parovarium.

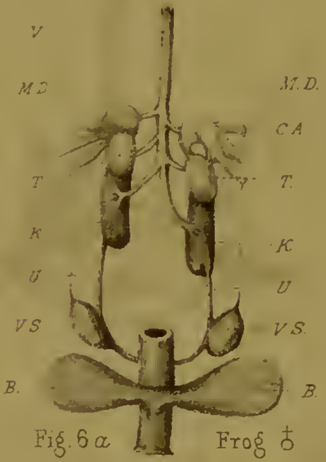
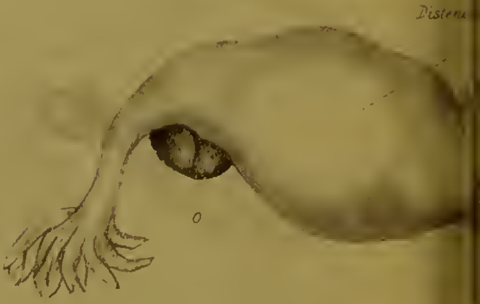


Fig. 6 α   Frog ♂



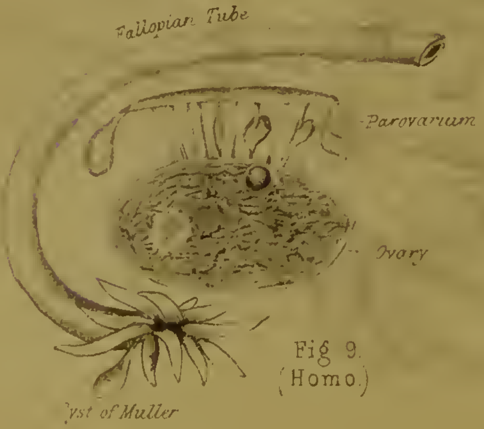


Fig 9.
(Homo.)

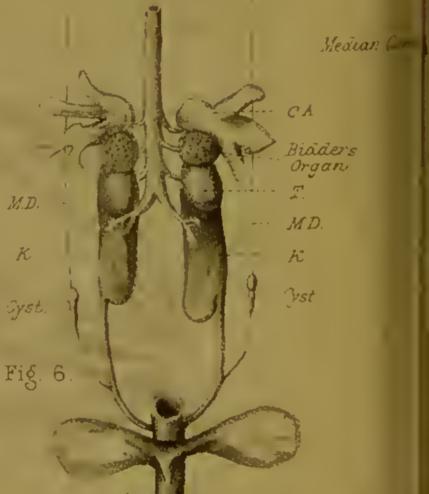
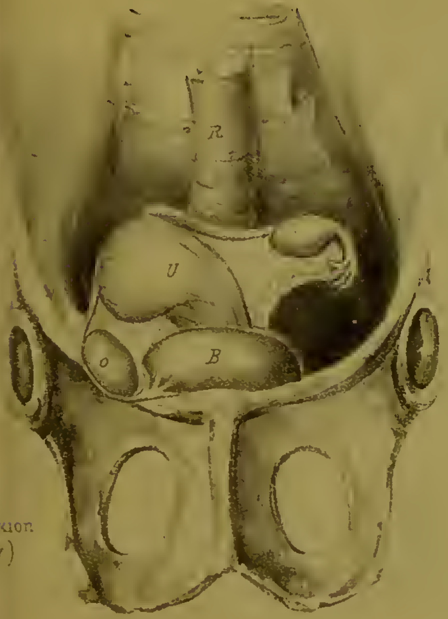


Fig. 6.

Bufo. Vulgaris ♀ (Reproductive Organs



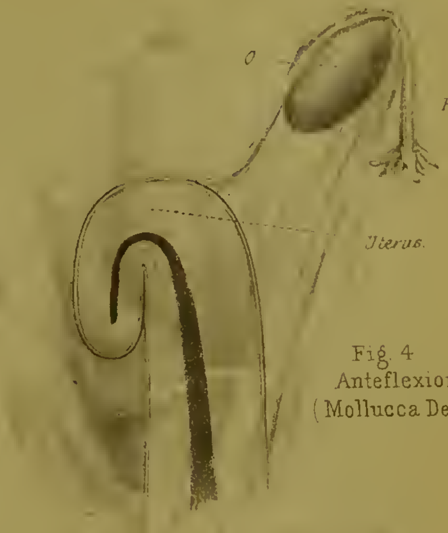


Fig. 4
Anteflexion.
(Mollucca Deer.)

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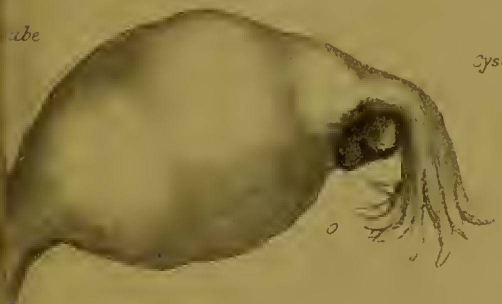

Fig. 5
Uterus of Kangaroo.
Pyo-Salpinx.

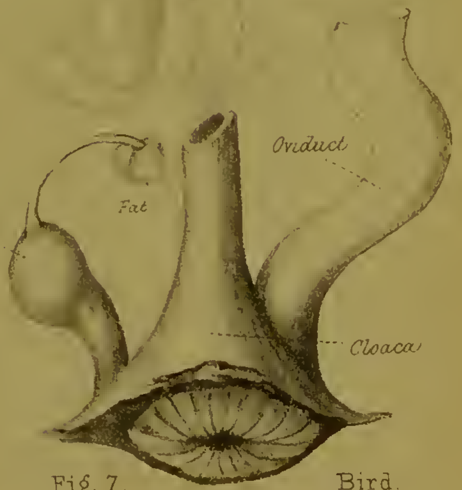

Fig. 7. Bird.

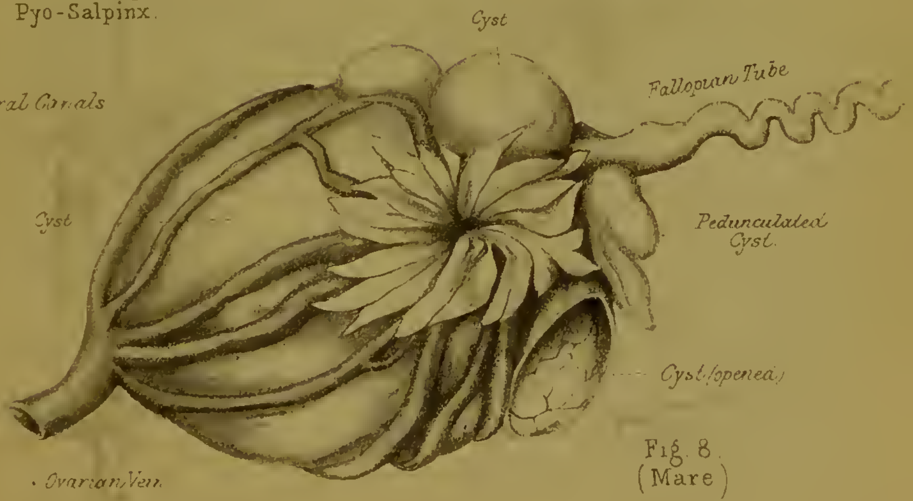

Fig. 8.
(Mare)